LATE PLEISTOCENE AND HOLOCENE TURKEYS IN THE SOUTHWEST

By Amadeo M. Rea[1]

ABSTRACT: Late Quaternary turkey remains from 17 southwestern sites are analyzed. All pre-agricultural turkeys, except those from northern Sonora and one cave in southern New Mexico, are found to be *Meleagris crassipes* L. Miller, an extinct species not closely related to the modern *M. gallopavo* Linnaeus, which inhabits much of the Southwest today. *M. gallopavo* is found associated with sedentary agriculturalists with a subsistence base of two or three crops at all other archaeological sites and time horizons. The major southwestern Indian cultures are herein delimited in time and space, emphasizing Mesoamerican components (particularly the four cultivars—maize, squash, gourd, beans—and macaws). It is proposed that the living turkey *M. g. merriami* Nelson is a parallel Mesoamerican component that was imported and became feral with the breakdown of southwestern cultures that had occurred by A.D. 1450, if not before.

It is currently believed that the Common Turkey, *Meleagris gallopavo* Linnaeus, occurred in the Southwest in the Pleistocene as well as the Holocene (=Recent) Epochs, evolving from local precursors (AOU 1957, Brodkorb 1964a; Schorger 1966; Steadman this vol.). The late Lyndon L. Hargrave long maintained (1970a:16, 25) that *M. g. merriami* Nelson, the subspecies of Common Turkey found today throughout most of the Southwest (Fig. 1), was derived from Pueblo Indian domesticated turkeys that became feral at the time of or following the breakdown and dispersal of the Anasazi Culture in the late thirteenth century. Hargrave's reasoning was that there were no Pleistocene or Pre-Basket Maker II cultural horizon Common Turkeys known from the Southwest. The independent discovery by Storrs Olson of the National Museum of Natural History, Smithsonian Institution, and by me, of the quite distinct paleospecies *Meleagris crassipes* L. Miller, in cave deposits in New Mexico, provided an opportunity to test Hargrave's hypothesis. Dr. Olson kindly placed the cave materials he was studying at my disposal because of the cultural (ethnobiological) ramifications of this problem. To resolve the question of the origin of *M. gallopavo,* a re-examination of all reputed pre-agricultural specimens of *M. gallopavo* throughout the range of modern *M. g. merriami* was necessary, particularly since both Olson and I found both *M. crassipes* and *M. gallopavo,* in the same cave deposits.

In this paper I shall attempt to present arguments that will provide answers to the following questions: (1) What were the geographic and temporal ranges of *M. crassipes* and *M. gallopavo* in the Southwest? (2) When did *M. crassipes* become extinct? (3) What was the relationship between the evolution of sedentary agricultural people and the domestication of the turkey in the area? (4) Did Puebloan peoples capture and domesticate birds from preexisting local wild populations, or were domestic turkeys imported along with Mesoamerican cultigens (maize, beans, pumpkins) and the macaw?

On the basis of the examination of existing fossil and archaeological remains, the first two questions can be answered with some degree of certitude, though carefully dated, stratified excavations might modify these answers. The third question will be sketched only in its broadest outlines, with the details left to the study by Charmion R. McKusick (this vol.). The final question cannot be answered directly, but a suggestion can be offered on the basis of available remains.

MATERIALS AND METHODS

Fossil and modern specimens cited in this report are distinguished by the following initials: AMNH (American Museum of Natural History), AMR (A.M. Rea Collection), FM (Field Museum), LACM (Natural History Museum of Los Angeles County), LLH (L.L. Hargrave Collection, Museum of Northern Arizona), MALB (Museum of Arid Land Biology, University of Texas, El Paso), MWU (Midwestern University), SC (Stanton's Cave, Museum of Northern Arizona), SD (San Diego Natural History Museum), TMM (Texas Memorial Museum, University of Texas, Austin), UA (Department of Ecology, University of Arizona), UAPL (Paleontology Laboratory, University of Arizona), USNM (National Museum of Natural History, Smithsonian Institution), and WAC (Western Archeological Center, Tucson).

All fossil and archaeological specimens were compared with the type series of *M. crassipes* (LACM), *M. californica* (LACM), and Recent wild *M. gallopavo* (total 31; *M. g. merriami, M. g. intermedia* Sennett, and *M. g. silvestris* Vieillot; AMR, UA, SD, LLH). Most of the cave material is not mineralized, except where noted. For identifications I used both qualitative and quantitative characters with a heavier reliance

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Contrib. Sci. Natur. Hist. Mus. Los Angeles County. 1980. **330:**209–224.

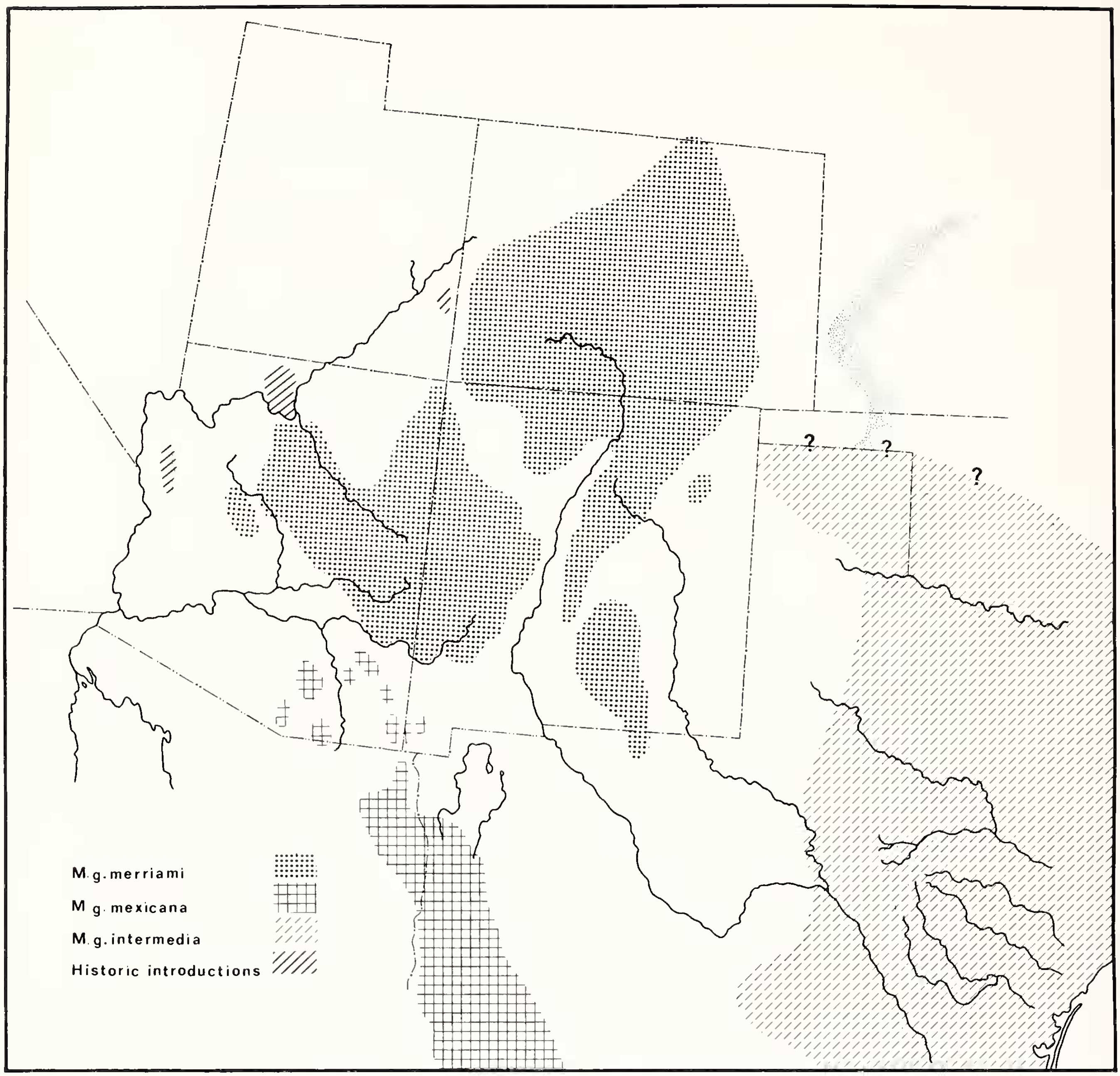

Figure 1. Historic (19th–20th Century) distributions of southwestern subspecies of *Meleagris gallopavo*. After European settlement, native turkeys were extirpated from the border ranges of southeast Arizona, and the areas were restocked with *M. g. merriami* starting early this century. Some forested areas of Utah and northwest Arizona, lacking historic populations, have been stocked with *M. g. merriami*. The Colorado and New Mexico range has been greatly reduced. (After Aldrich and Duvall 1955; Bailey 1929; Bailey and Neidrach 1965; Phillips et al. 1964; Schorger 1966; and other sources.)

on qualitative differences between the two species where possible. Most qualitative characters are given by Steadman (this vol.), although a few additional characters are mentioned below. Osteometric data are also given by Steadman (this vol.). Radiocarbon dates are followed by the standard deviation, with the laboratory and sample number in parentheses. All measurements are in millimeters. I have used two systems of dating throughout: years before present (B.P.) for dates older than 2000, and A.D. designations of the Gregorian calendar for those younger. Paleontologists more frequently use the former, prehistorians the latter. Breaking at A.D. 1/2000 B.P. appears to be the least awkward compromise.

SYSTEMATICS

Meleagris crassipes has been known since its discovery and description (Miller 1940, 1943) only from San Josecito Cavern in southern Nuevo León, México, on the east flank of the Sierra Madre Oriental. The species is represented by over 50 elements, mostly limb bones. The scapula, one character of which is most important in the evolutionary history of turkeys (Steadman this vol.), is unknown. The associated fauna of San Josecito Cavern includes the Rancholabrean land mammals *Canis dirus, Nothrotherium* sp., *Equus* sp., *Tetrameryx* sp., *Felix atrox,* and *Smilodon* sp. Extinct birds include *Coragyps occidentalis* (L. Miller) (=*C. atratus*? (Bechstein)), *Teratornis merriami* L. Miller, *Spizaetus grinnelli* (L. Miller), *Neogyps errans* L. Miller, *Neophrontops americanus* L. Miller, *Wetmoregyps daggetti* (L. Miller), and *Polyborus prelutosus* Howard (Miller 1943). *Meleagris crassipes* is a distinctive species, showing little similarity to the two living species of turkeys, *M. gallopavo* and *M. ocellata* Cuvier, or to their immediate precursors. Instead, it appears to have been a dead-end side branch in the evolutionary history of turkeys (Steadman this vol.). *M. crassipes* was a small turkey with relatively large legs, and little sexual dimorphism in size. San Josecito Cavern had surface evidence of human occupancy, but all the bird bones were recovered from "below the zone of human activity" (Miller 1943:144).

I am convinced that the osteological and external differences between the two living species of turkeys are insufficient to warrant placing them into separate monotypic genera, *Agriocharis* Chapman and *Meleagris* Linnaeus. The supposed generic characters are almost exclusively a matter of secondary sexual characteristics, such as the position, angle, and length of metatarsal spur, and the male head and chest ornamentation. The structure and color pattern of the wing, mantle, rump, and breast feathers of the two living species are strikingly similar. Osteologically, Holocene *M. gallopavo* and *M. ocellata* more closely resemble each other than either does *M. crassipes*. Ridgway (*in* Ridgway and Friedmann 1946:458) noted, "*Agriocharis* is, in fact, so closely related to *Meleagris* that I am somewhat doubtful as to the expediency of recognizing it as a genus." Brodkorb (1964a, b) removed the fossil species *M. leopoldi* A. Miller and Bowman and *M. crassipes* from *Meleagris,* leaving in that genus the three species *M. alta* Marsh, *M. tridens* Wetmore, and *M. gallopavo* Linnaeus. I regard *Agriocharis* as a synonym of *Meleagris,* thus returning the species *M. ocellata* Cuvier, *M. leopoldi* A.H. Miller and Bowman, and *M. crassipes* L.H. Miller to *Meleagris,* along with *M. progenes* (Brodkorb) and *M. anza* (Howard). I also strongly doubt that *M. californica* (L. Miller) is sufficiently distinct to merit being placed in the separate genus *Parapavo* L. Miller, and prefer considering it as well a species of *Meleagris*. Steadman (this vol.) has independently reached similar conclusions.

Finally, the so-called New World family Meleagrididae seems to me unjustifiable. The two living species and their paleo-antecedents are merely medium to large pheasants. I recommend placing them in the family Phasianidae, together with the spurred fowl of the Old World.

FOSSIL AND EARLY ARCHAEOLOGICAL RECORDS OF *MELEAGRIS* IN THE SOUTHWEST

STANTON'S CAVE, Coconino Co., Arizona. Grand Canyon, 51 river km below Lee's Ferry. Distal end of tarsometatarsus (SC 76). This bone was obtained from a packrat nest in the cave. Individual nests have not been dated, but the cave floor deposit ranges from 38,000 B.P. to present, with the bulk of the material being Pleistocene (Euler 1978). Bird bones recovered from the cave include *Teratornis merriami, Gymnogyps amplus* L. Miller (=*G. californianus*? Shaw), *G. californianus*, and *Centrocercus urophasianus* (Bonaparte). All of these species are absent from the area today. Mammals include *Oreamnos harringtoni* and *Bison* sp. The packrat nest was burned by vandals before the cave was excavated, so the tarsometatarsus is slightly calcined but not distorted. The specimen is clearly from *M. crassipes* on the basis of characters and lies within the upper size range of the specimens from San Josecito Cavern. The only evidence of human activity in Stanton's Cave was the presence of caches of split willow twig figurines, dated 3000–4000 B.P. (Euler 1978:158). The cave was never a habitation site.

LAGUNA SALADA, Apache Co., Arizona. Distal end of tibiotarsus (FM uncatalogued). Martin and Rinaldo (1960:115) reported the tibiotarsus of a turkey, *M. gallopavo,* taken at a playa camp site on the Upper Colorado, radiocarbon dated 3280 ± 60 (Gro. 1614) B.P. I have re-examined this bone and find it to be from a Sandhill Crane, *Grus canadensis* (Linnaeus). Certain bones of *Grus* and *Meleagris* are superficially similar (Hargrave and Emslie 1979).

PAPAGO SPRINGS CAVE, Santa Cruz Co., Arizona. Complete humerus (AMNH 8683, 8687); distal half of right humerus (AMNH 8693); proximal half of right femur (AMNH 8684); proximal two thirds of right femur (AMNH 2685); all mineralized. Steadman (pers. comm.) found these specimens indistinguishable from those of female *M. gallopavo* or male *M. crassipes.* I cleaned these fossils of some heavy matrix to expose critical characters for identification. The complete humerus is from *M. crassipes.* It differs from *M. gallopavo* in: much greater protrusion of head anconad, especially mediad; narrower capital groove; and very much smaller and differently shaped impression of M. brachialis anticus. Its length is about 121.8 mm. The scar of M. latissimus dorsi is not exposed. The partial humerus is from *M.* cf. *crassipes.* The impression of M. brachialis anticus is very short and broad, not extending up the shaft as in *M. gallopavo.* Its distal width is 26.5 mm. The femora are from *M. crassipes.* They differ from *M. gallopavo* in: very much wider neck, not pinched off; thicker ridge on posterior view separating trochanter from head and neck (2.5 mm vs. a fine line in equivalent-sized *M. gallopavo*); and general configuration of obdurator ridge area. The fauna of Papago Springs Cave is late Pleistocene, with abundant fossils of the extinct pronghorn, *Stockoceros onuscrosagris,* as well as *Camelops* sp., *Bison* sp., *Platygonus* sp., and two species of *Equus* (Skinner 1942).

NORTH PAPAGO (SONOITA) CAVE, Santa Cruz Co., Arizona. Complete tarsometatarsus lacking spur (AMNH 8686). This specimen is from *M. crassipes.* This cave is an extension of the above and is presumably the same age.

ARIZPE, Sonora, México. Río San Miguel drainage 97 km southeast of Cananea. Head of humerus (AMNH 6823), mineralized. This bone was identified by Cracraft (1968) as *M. gallopavo.* I can find no characters to distinguish it from a large male of that species. It is far too large (width of head, 38.9 mm) for *M. crassipes,* but it could be a very large *M. californica.* Steadman (this vol.) considers the character differences of the head of the humerus noted by Cracraft (1968) too inconsistent for a specific identification between *M. gallopavo* and *M. californica.* I refer the humerus to *M. gallopavo* on geographic probability. This deposit from northeastern Sonora yielded *Bison* cf. *alleni* and *Equus* cf. *tau*, suggesting a late Pleistocene age.

LA BRISCA, Sonora, México. Río San Miguel drainage about 25 km northwest of Arizpe. Distal end of ulna (IGCU-2546), mineralized. Size is not diagnostic in this specimen (distal width, 13.0 mm). Steadman's measurements (this vol., Tables 10, 11) indicate that the specimen lies within the size range of female *M. gallopavo*, female *M. californica*, or male *M. crassipes*. The ulna of *M. crassipes* is distinguishable from both *M. gallopavo* and *M. californica* on the basis of the shape of the internal condyle (short, almost squared in the former; broadly rounded in the latter two). The fossil ulna is the latter type. On the basis of this character and geographic probability I refer the La Brisca fossil to *M. gallopavo*.

TULAROSA CAVE, Catron Co., New Mexico. FM 73,2504 and 73,648, tarsometatarsi; 73,647, coracoid lacking part of head; 73,2247, head of coracoid; all from the pre-pottery occupational phase, radiocarbon dated 2300 (±200) to ca. 2150 years B.P. (Additional turkey bones recovered from younger cultural levels not re-examined.) All four elements are *M. gallopavo*. The tarsometatarsi are smaller and appear more gracile than in the wild female *M. g. merriami* living in the area today. The pathological coracohumeral surface of one coracoid suggests captivity.

SAN ANTONIO SITE, Socorro Co., New Mexico. Río Grande south of Socorro, 5.6 km NE San Antonio. USNM 14690: distal end of humerus; radius, lacking distal end; nearly complete ulna. Steadman (pers. comm.) examined these bones and could find no qualitative characters. Measurements are: humerus, distal width 23.8 mm; ulna: length 101.8+ mm, distal depth 12.3 mm; radius: proximal width 7.9 mm, proximal depth 8.3 mm. On the basis of measurements (Steadman this vol., Tables 8 through 13), I refer these specimens to *M. crassipes*. The fossils are from the base of a pumicite bed and there were no other associated bones. They are presumed to be Pleistocene, perhaps Blancan (Needham 1936).

HOWELL'S RIDGE CAVE, Grant Co., New Mexico. There have been three excavations of this cave deposit, two producing bones of *Meleagris*. Zeller-Howard pit: coracoid head (LACM 33890), scapula (LACM 33889), proximal and distal ends of an ulna (LACM 33891, 33892). Van Devender pit: tarsometatarsus, rodent gnawed on trochleae and most of head (SD uncataloged). No stratigraphic data were recorded on materials recovered from the Zeller-Howard pit, but Howard (1962) presumed that they were of late Pleistocene or Holocene age. Associated (Howard 1962) were *Equus* sp., *Camelops* sp., abundant *Gymnogyps amplus* (=*G. californianus*?) (including young), *Coragyps occidentalis* (=*C. atratus*?), and single elements of *Spizaetus* sp. and *Anabernicula* sp. Howard (1962:242) considered only the possibility that the turkey was either *M. gallopavo* or *M. californica*. She very tentatively referred the turkey elements to *M. gallopavo*. I identified the proximal end of the ulna (33891) as from *M. crassipes* on the basis of the short, distinctly squared shape of the internal condyle. After further cleaning of the head of the coracoid, I am inclined to consider it a specimen of *M. crassipes* rather than *M. gallopavo* or *M. californica* on the basis of the shape of the coracohumeral surface (broader, less triangular). The Howell's Ridge scapula has an almost obsolete foramen, unlike the known *M. gallopavo* and *M. californica* where the foramen is well developed, and it well may represent *M. crassipes*.

The large galliform bones recovered from the Harris pit (UTEP) are *Centrocercus urophasianus*. Van Devender (Van Devender and Worthington 1978) excavated additional parts of this cave with careful stratigraphic controls. Several large galliforms were obtained from the 90–100 cm level, midway between radiocarbon dates of 3330 ± 170 B.P. (A-1354) on the 70–80 cm level, and 6697 ± 324 B.P. (average of A-1429 and A-1430) on the 110–112 cm level. Both dates are based on endocarps of *Celtis reticulata* (netleaf hackberry). The 90–100 cm level includes the nearly complete and excellently preserved tarsometatarsus of *M. crassipes*, apparently a mature female (no evidence of spur attachment). The other galliforms from this stratum are *Centrocercus urophasianus*. Zeller (Howard 1962:241) suspected human association on the basis of a few flint chips and charcoal, but Van Devender and Harris (pers. comm.) found no suggestion of human occupation.

SHELTER CAVE, Doña Ana Co., New Mexico. Incomplete humerus (LACM 1010/653), two pedal phalanges (LACM 1010/657), distal ends of right and left ulnae (LACM 1010/556, 557). The humerus more closely resembles topotypes of *M. crassipes* than Hargrave's extensive series of *M. gallopavo merriami* in such characters as: (1) general greater curvature of the shaft; (2) size (least depth of shaft 9.4 mm); (3) very small brachial depression; and (4) small, slender depression for M. latissimus dorsi. The pedal phalanges cannot be identified to species. The ulnae are identical to those of *M. crassipes*, except one measures slightly larger (16.0 mm) than the largest of six ulnae (14.1 to 15.6 mm) of *M. crassipes* from San Josecito Cavern. Associated with these specimens are *Gymnogyps californianus*? and the extinct species *Urubitinga fragilis*, *Geococcyx conklingi* Howard, and *Pyelorhamphus molothroides* A. Miller, all indicating Late Pleistocene age, but with evidence of Basket-Maker-like (Archaic) material culture overlying the fore part of the cave (Howard and A. Miller 1933). This cave and the following are on the west and east sides, respectively, of Pyramid Peak in the southern Organ Mountains, north of El Paso, Texas.

CONKLING CAVERN, Doña Ana Co., New Mexico. Shaft of humerus (LACM 1009/21), carpometacarpus (LACM 1009/22), distal end of radius (LACM 1009/23). The humerus, from the 20–23 foot level, is far too large (least diameter of shaft, 11.9 mm; Steadman this vol., Tables 8, 9) and too straight for *M. crassipes*, but agrees with that of male *M. gallopavo*. The brachial depression is not deep, but its size and shape resemble those found in *M. gallopavo*. Surface striations indicate immaturity. The carpometacarpi of *M. crassipes* and *M. gallopavo* can be distinguished by the outer curvature of the distal end of metacarpal III, but this area is broken on specimen 1009/22. Measurements of the carpometacarpus are: proximal depth 23.4 mm, minimum axial length 75.6 mm, and maximum axial length (78.2+ mm). These measurements are all too large for *M. crassipes* and greater than the largest *M. californica* measured by Steadman (this vol., Tables 14, 15). Its provenience is marked "dump" (presumably material outside the cave disturbed by treasure hunters, lacking stratigraphic data). The radius, also lacking provenience data, measures 12.8 mm in distal width. I consider all three elements to be *M. gallopavo*. Associated specimens from Conkling Cavern are *Coragyps occidentalis* (=*C. atratus*?), *Gymnogyps californianus, Geococcyx conklingi,* as well as *Centrocercus urophasianus* and *Cyanocephalus cyanocephalus,* two species living today in more northern arid regions (Howard and Miller 1933). Mammals include extinct *Equus* sp., an ursid, *Hemiauchenia* sp., *Camelops* sp., and *Nothrotherium.* There were human remains (presumably Paleo-Indian) at the 10 and 21 foot levels, but no Late Archaic material culture. At the 20 foot level there was a hard, water-deposited, horizontal lens, precluding the possibility of intrusive burial (Bryan 1929). Howard and A. Miller (1933:17) consider the better stratified lower levels of Conkling Cavern to be Pleistocene.

DRY CAVE, Eddy Co., New Mexico. Guadalupe Mountains. Distal end of tarsometatarsus (trochlea gnawed by rodent) (MALB 5-239). This specimen of *M. crassipes* was excavated by A.H. Harris from the Sabertooth Camel Maze section of Dry Cave. The fossil remains are dated 25,160 ± 1730 B.P. This portion of the cavern was sealed so that it was not contaminated with younger materials (Harris pers. comm.). Associated animals include *Breagyps clarki, Canis dirus, Camelops* sp., *Tapirus* sp., and *Equus* sp.

BURNET CAVE, Eddy Co., New Mexico. East slope of Guadalupe Mountains, about 80 road km west of Carlsbad. Shaft of humerus (ANSP 14161); carpometacarpus (ANSP 13495); femur, lacking distal end (ANSP 14134); tarsometatarsus with spur (ANSP 13492); tibiotarsus, lacking proximal end (ANSP 14133). The upper 0.5 to 1 meter of the open cave deposit have Basket-Maker-like burials, but lack corn cobs and pottery (Schultz and E. Howard 1935:273–274). Beneath 1 meter, extending to a depth of 3 meters, were numerous hearths and "Folsom-like" artifacts associated with extinct mammals (*Bison antiquus, Preptoceras sinclairi, Stockoceros onusrosagris, Euceratherium collinum*) and the condor *Gymnogyps californianus.* The spurred tarsometatarsus and the carpometacarpus, both recovered in the 5 ft 9 in. stratum, are from *M. crassipes.* The femur (stratum unknown) also appears to be from *M. crassipes* (muscle lines and other characters) and is buff-tan colored like the previous two elements. The tibiotarsus (14133) is too large and too long for *M. crassipes* (width across distal cotyla 18.4 mm vs. maximum 17.4 mm in *M. crassipes*; distance from distal end of scar for attachment of fibula to distal end 122.7+ mm vs. maximum 104.3 mm in *M. crassipes*; Steadman this vol., Tables 18, 19). The shaft of the humerus (14161) is too straight and too large for *M. crassipes.* Both the tibiotarsus and humerus fit *M. gallopavo,* the humerus being in the size range of a male. These latter two bones, as Olson (pers. comm.) has pointed out, are quite white in color, in contrast to the brownish (and probably older) *M. crassipes* from this deposit. These two elements were presumably associated with the upper 0.5 meter of deposit containing Archaic cultural remains.

DARK CANYON CAVE, Eddy Co., New Mexico. About 25 km southwest of Carlsbad. Nearly complete coracoid (AMR, uncataloged). Howard (1971:237–240) reported on a large portion of this enormous deposit, although thousands of bird bones still remain to be identified. She reported two turkey bones, listing them as "*Meleagris gallopavo*?" These and certain other galliform bones were returned to the late L.L. Hargrave, and cannot now be found in his collection. The cave contained abundant teeth of *Equus* sp., and many extinct avian species, including *Anabernicula* sp., *Gymnogyps amplus* (=*G. californianus*?), *Coragyps occidentalis* (=*C. atratus*?), *Neophrontops* sp., *Geococcyx conklingi,* and others. The deposit containing the extinct species was overlain with Basket-Maker-like material culture.

A coracoid, lacking part of the sternal facet, was obtained during subsequent excavations at approximately the 15 foot level. The distinctive shape of the coracohumeral surface and additional characters mentioned by Steadman (this vol.) indicate that it is from *M. crassipes.* Measurements of the specimen are: head to internal distal angle 70.5 mm; head through scapular facet 26.3 mm; least width of shaft 7.6 mm. It was associated with the coracoid of *Gymnogyps* sp.

PRATT CAVE, Culberson Co., Texas. McKittrick Canyon, south of Carlsbad, Guadalupe Mountains. Fragmental distal end of humerus (WAC 38A1); fragmental distal end of shaft of tibiotarsus (WAC 35A1); distal end of tibiotarsus (WAC 2599/34A1). There is some question of the antiquity of this deposit. I have re-examined the extralimital pigeon, *Columba flavirostris* Wagler (distal end of humerus), and the extinct roadrunner, *Geococcyx conklingi* (proximal end of tibiotarsus), identified from the deposit by Hargrave. I find the humeri of *C. flavirostris* and *C. fasciata* Say, the species of pigeon to be expected at the site, to be indistinguishable, even using the comparative materials from the Hargrave Collection (all the *C. flavirostris* specimens being from captive birds). The bone from Pratt Cave is undoubtedly *C. fasciata.* Rob McKenzie and I have compared the roadrunner tibiotarsus with the type series (LACM) of Conkling's Roadrunner, finding that it indeed appears to be *G. conklingi,* though it is slightly larger and somewhat different in characters. This cave lacks an extinct megafauna, and the herpetofauna is also modern. The entire deposit appears to be less than 6000 B.P. (Gehlbach and Holman 1974:191, 195). The late Archaic remains are radiocarbon dated 2320 ± 70 to 1420 ± 60 B.P. A. Schroeder (pers. comm.) provided stratigraphic data on the cave showing that all the turkey bones are from cultural levels in the cave. The fragmentary humerus is the size of a large male *M. gallopavo* (depth through internal condyle 12.5 mm; depth through external condyle 27.6 mm). The shaft of a tibiotarsus is immature and burned at the distal end. It cannot be identified to species. The distal end of tibiotarsus from a test pit is the size of a large female *M. gallopavo.* Steadman (this vol.) finds no diagnostic characters in distal ends of tibiotarsi.

LUBBOCK LAKE, Lubbock Co., Texas. Llano Estacado (southern High Plains), north of the Edwards Plateau. Restored fragments of distal end of tibiotarsus (TTU-A1399) and humerus (TTU-A1391); two pedal phalanges (TTU-A1390, 1443). These several fragmentary elements, from the same horizon in a Clovis Man level, are referred to a single individual. They are not identifiable to species. The date is late Pleistocene (12,000–11,000 B.P.). The associated megafauna includes *Mammuthus* sp., *Equus* sp., *Camelops* sp., *Bison* sp., and *Tapirus* sp. (Johnson 1977:65).

KLEIN CAVE, Kerr Co., Texas. South-central Texas, northwest of San Antonio. Distal end of femur (MWU 9110). The cave deposit is dated at 8000 B.P. (Roth 1972). The lack of an extinct megafauna is attributed to the shallowness of the cave (Roth 1972:77). Mammals from the cave that require a mesic habitat and are no longer found on the Edwards Plateau

Table 1. Late Pleistocene and early Holocene paleontological remains from the southwest.

Cave, Location	Species	Element	Provenience	Association	Age	Original Source
STANTON'S CAVE Coconino Co., Ariz.	*Meleagris crassipes*	tarsometatarsus	packrat midden	*Teratornis*, *Gymnogyps*, modern fauna	38,000 B.P. to Recent	Rea and Hargrave MS
LAGUNA SALADA Apache Co., Ariz.	*Grus canadensis*	tibiotarsus	camp site	cultural	3280 ± 60 B.P.	Martin and Rinaldo 1960
PAPAGO SPGS. CAVE Santa Cruz Co., Ariz.	*M. crassipes*	humerus	none	Pleistocene megafauna	Late Pleistocene	Skinner 1942
	M. cf. *crassipes*	humerus				
	M. crassipes	2 femora				
NORTH PAPAGO CAVE Santa Cruz Co., Ariz.	*M. crassipes*	tarsometatarsus	none	Pleistocene megafauna	Late Pleistocene	
ARIZPE Sonora, México	*M.* cf. *gallopavo*	humerus head	none	*Bison*, *Equus*	Late Pleistocene	Cracraft 1968
LA BRISCA Sonora, México	*M.* cf. *gallopavo*	ulna	surface	*Strix brea*, *Equus*	Late Pleistocene	
TULAROSA CAVE Catron Co., N. Mex.	*M. gallopavo*	2 tarsometatarsi 2 coracoids	pre-pottery level	cultural	2300–2150 B.P.	Martin et al. 1952
SAN ANTONIO SITE Socorro Co., N. Mex.	*M.* cf. *crassipes*	humerus ulna radius	base of pumicite bed	none	Early? Pleistocene	Needham 1936
HOWELL'S RIDGE CAVE Grant Co., N. Mex.	*M. crassipes*	ulna	none (Zeller-Howard pit)	*Equus*, *Camelops*, *Gymnogyps*, *Coragyps*, *Spizaetos*	presumed late Pleistocene	Howard 1962
	M. crassipes?	scapula				
	M. crassipes	coracoid				
	M. crassipes	tarsometatarsus	90–100 cm level	*Centrocercus urophasianus*	3330–6697 B.P.	Van Devender and Worthington 1978
SHELTER CAVE Doña Ana Co., N. Mex.	*M. crassipes*	humerus	none	*Gymnogyps*, *Pyelorhamphus*, *Geococcyx conklingi*	Late Pleistocene to Late Archaic "Basket Maker"	Howard and A. Miller 1933
	M. crassipes	2 ulnae				
LUBBOCK LAKE Lubbock Co., Texas	*Meleagris* sp.	tibiotarsus humerus fragments	Clovis Man level	*Mammuthus*, *Tapirus*, *Equus*, *Camelops*	12,000–11,000 B.P.	Johnson 1977, Rea in press
KLEIN CAVE Kerr Co., Texas	*M. gallopavo*	femur	?	*Synaptomys cooperi*, *Mustela erminea*, *Tamias striatus*	8000 B.P. (noncultural)	Roth 1972, Feduccia 1972
SAN JOSECITO CAVERN Nuevo León, México	*M. crassipes*	>50 elements	below cultural zone	*Teratornis*, *Gymnogyps*, *Smilodon*, *Tetrameryx*, *Equus*, *Nothrotherium*	Late Pleistocene	Miller 1943
INGLESIDE PIT San Patricio Co., Texas	*M. gallopavo*	3 tibiotarsi 2 tarsometatarsi 1 coracoid		*Ciconia maltha*, *Gopherus hexagonata*, *Geochelone*, *Mammuthus*, *Mammut*, *Camelops*	Late Pleistocene	Feduccia 1973, Steadman (this vol.), Lundelius 1972
CONKLING CAVERN Doña Ana Co., N. Mex.	*M. gallopavo*	radius	none	*Coragyps*, *Gymnogyps*, *Camelops*, *Equus*	Paleo-Indian 13,000–9000 B.P.	Howard and A. Miller 1933
	M. gallopavo	humerus shaft	6 to 7 m level			
	M. gallopavo	carpometacarpus	"dump"			

Table 1. Continued.

Cave, Location	Species	Element	Provenience	Association	Age	Original Source
DRY CAVE Eddy Co., N. Mex.	*M. crassipes*	tarsometatarsus		*Breagyps, Canis dirus, Camelops, Tapirus, Equus*	25,000 B.P.	Harris 1978
BURNET CAVE Eddy Co., N. Mex.	*M. crassipes*	tarsometatarsus	5′9″ (1.75 m)	Folsom-like artifacts; *Bison, Tetrameryx, Gymnogyps*	Late Pleistocene	Schultz and E. Howard 1935, Wetmore 1932
	M. crassipes	carpometacarpus				
	M. crassipes	femur				
	M. gallopavo	tibiotarsus	none (upper 0.5 m?)	presumably Late Archaic		
	M. gallopavo	humerus				
DARK CANYON CAVE Eddy Co., N. Mex.	? (lost)	unknown (2)	unknown	*Gymnogyps, Coragyps, Anabernicula, Neophrontops, Equus*	Late Pleistocene	Howard 1971
	M. crassipes	coracoid	4.5 m, new pocket	*Gymnogyps, Equus*	Late Pleistocene	
PRATT CAVE MKA-1 Eddy Co., N. Mex.	*M. gallopavo* *Meleagris* sp.	humerus tibiotarsi	cultural	*Geococcyx conklingi,* and modern fauna, Late Archaic	2320–1420 B.P.	Unpublished report

include *Tamias striatus, Microtus pennsylvanicus, Synaptomys cooperi, Mustela erminea, Myotis lucifugus,* and *Myotis evotis.* This indicates a climatic shift from cool, moist conditions to warm, dry conditions on the plateau. Roth (1972) found no evidence of human habitation in Klein Cave. Feduccia (1972) identified the distal end of a femur as *M. gallopavo* within the size range of a female. Steadman (this vol.) considers the depth of the intercondylar fossa to be a diagnostic character between *M. crassipes* and *M. gallopavo,* and we could not distinguish the Klein Cave specimen from three recent wild female *M. gallopavo* at hand. This is the westernmost specimen of *M. gallopavo* from the late Pleistocene/early Holocene, exclusive of Sonora and southwest New Mexico, not directly associated with man.

INGLESIDE PIT, San Patricio Co., Texas. About 1.5 km inland from the Gulf of Mexico. Feduccia (1973:143) reported six bones (all mineralized): coracoid (TMM 30967-1741), tibiotarsi (TMM 30967-1139, 30967-1063B, 30967-1564), tarsometatarsi (TMM 30967-1169, 30967-1467) as *M. gallopavo.* Steadman (this vol.) has re-examined the material and agrees with Feduccia's identification. The fauna is late Pleistocene.

In summary, this critical evaluation of turkey remains from the Southwest (Table 1; Fig. 3) shows that *M. crassipes* was widespread from Nuevo León, México, to the Grand Canyon, Arizona, in the late Pleistocene. In most caves it is associated with other extinct birds and Rancholabrean land mammals. The earliest radiocarbon date for *M. crassipes* is 25,000 B.P. (Dry Cave, New Mexico), and it persisted at least until some time between 3300 and 6600 B.P. (Howell's Ridge Cave, New Mexico). Its presence in greater numbers in southern New Mexico reflects the large number of cave deposits with bones of smaller vertebrates in that area. *M. crassipes* does not appear temporally sympatric with *M. gallopavo* in any deposit. So far there is no direct evidence that early man played a role in the extinction of this medium-sized turkey.

The late Pleistocene to early Holocene turkey specimens referred to *M. gallopavo* are restricted to southern New Mexico (Conkling Cavern), northern Sonora (Arizpe, La Brisca), the south-central and Gulf portions of Texas (Klein Cave and Ingleside Pit), and points east (Steadman this vol.). Throughout the remainder of the Southwest, *M. gallopavo* occurs only after Paleo-Indian times in association with the remains of sedentary agriculturalists.

There are three hypotheses that might explain the unusual distributions of the two turkey species from the Southwest:

1. *M. crassipes* and *M. gallopavo* occurred sympatrically in the Southwest from the late Pleistocene onward, but only *M. crassipes* was taken into caves by predators; *M. crassipes* became extinct, but *M. gallopavo* persisted. I consider differential predation unlikely. The male of *M. crassipes* was as large as a female *M. gallopavo.* If both species were present there should have been an equal chance of either species being deposited in caves by predators.

2. *M. crassipes* was the only turkey present in the Southwest. When it became extinct *M. gallopavo* extended its range from the east or the south to fill the vacated area. There is nothing intrinsically wrong with this hypothesis and it cannot be proven or disproven. However, climatic factors would seem to discredit the idea of a natural invasion by this large and relatively sedentary species. During the Holocene the Southwest underwent a general trend toward a warmer, dryer climate, with woodlands giving way to grasslands and deserts and xeric-adapted plants from México migrating northward at about the time *M. gallopavo* would have been invading (Van Devender 1976, 1977; Van Devender and Wiseman 1977; Wells 1966; Wells and Berger 1967). Forests became more and more restricted to mountain islands in the Southwest and the

juniper-piñon-oak woodlands retreated upslope 260 to 1000 meters (Van Devender and Spaulding 1979). The modern species of turkey would have been invading as its preferred habitat of woodlands was shrinking.

3. A third hypothesis is that (a) only *M. crassipes* occupied the niche of a large phasianid bird during the late Pleistocene, but became extinct during the Holocene; (b) man imported *M. gallopavo,* along with other domesticated plants and animals; (c) these turkeys escaped, forming a feral population north of *M. g. mexicana* and west of *M. g. intermedia.* Any serious consideration of this hypothesis requires a look at the evolution of sedentary cultures in the Southwest, the development of Mesoamerican cultivars, the development of trade routes between Mesoamerica and the Southwest, the transmission of cultural items, and finally, the present distribution and characteristics of the various subspecies of *M. gallopavo.*

THE EVOLUTION OF SEDENTARY CULTURES IN THE SOUTHWEST

Paleo-Indians and Desert Culture

The waves of early man sweeping across the North American continent from Asia are called Paleo-Indians. These cultures are usually characterized by their distinctive lithic artifacts; Clovis and Folsom people are well-known examples. Paleo-Indians are usually characterized as megafauna (big game) hunters who exploited many now extinct mammal species, beginning sometime between 15,000 and 10,000 B.P. They also hunted smaller game (Jennings 1974:90–92; Johnson 1977). The somewhat younger Desert Culture of the Archaic stage not only included the Southwest and Great Basin (McGregor 1965:124–125) but extended from southeast Oregon to the Valley of México (Martin and Plog 1973:69). The Cochise Complex, a part of this widespread Desert Culture, occupied much of the arid Southwest, lasting in places as late as 2000 B.P. Regardless of the names and times, these cultures, until at least late Cochise times (Dick 1965:100; Martin and Schoenwetter 1960:33–34), were pre-ceramic and pre-agricultural, dependent entirely on hunting and gathering (especially seeds) for subsistence.

Anasazi Culture (Colorado Plateau)

Some knowledge of three subsequent cultures, the Anasazi, Mogollon, and the Hohokam (Fig. 2) are critical to understanding the pre-history of *M. gallopavo* in the Southwest. The Archaic phenomenon was a general cultural stage that spread across North America from 8–9000 to 2–4000 B.P. It was best developed in the Southwest (or at least is best known there because of the circumstances of preservation in this arid region) (Amsden 1949; A. Morris 1933:39–55; McGregor 1965:170–186; 206–217; Wormington 1978:27–57; Jennings 1974:134; Martin and Plog 1973:81). The late Archaic San Juan peoples from the Anasazi or Four Corners region (San Juan and Little Colorado drainages) developed through several cultural stages (Basket Maker II and III; Pueblo I through IV), ending in the post-conquest pueblos of today such as Hopi, Acoma, and Zuni. (The cultural stage Basket Maker I is a hypothetical proto-agricultural stage that has not been discovered.)

Basket Maker II people, dating approximately A.D. 300–500 (McGregor 1965:471) are characterized by finely woven sandals and other textiles, atlatls for hunting, and corn/squash agriculture. The turkey appears in deposits from this time period *only* as feathers or feathered artifacts (Hargrave 1970a; Emslie and Hargrave 1978), not as bones. Toward the end of Basket Maker III time (McGregor [1965:215] puts this around A.D. 600–700), the turkey was certainly domesticated in the regions occupied by the Anasazi and evidence of whole turkey skeletons (almost never individual elements) appears (A. Morris 1933:196–197; E. Morris 1939:120). At approximately the same time, Basket Maker III culture underwent three critical advances, one technical (development of fired pottery), and two agricultural (introduction of beans [*Phaseolus* sp.] and the appearance of newer and larger varieties of corn [*Zea mays*]). The bow and arrow appeared about this time (Amsden 1949:133; Wormington 1978:55) or somewhat earlier.

Early Basket Makers used mammal fur cordage for twining blankets and for clothing. Later in the culture, feathers, particularly from turkeys, were used for this purpose (Hough 1914:5–6, 71–73; Wormington 1978:55, 89; A. Morris 1933:197; Amsden 1949; McGregor 1965:181, 215; Lange 1950.) Amsden pointed out that the fur-cord robes were astonishingly heavy but that turkey-feather material had the advantage of lightness. At this time turkey feathers were also starting to be used for ceremonial purposes. The intensive use of turkey feathers continues in the complex religious ceremonies of today's Pueblo Indians.

Pueblo II and III peoples had their greatest expansion between A.D. 900 and 1100 (see map, McGregor 1965:279). There is evidence (turkey bone awls and individual elements, occasionally charred, disposed of in trash mounds) that, beginning in this period, the turkey was used for food, at least locally. But at earlier sites of these peoples only whole birds occur as carefully interred burials (A. Morris 1933:196–197; Reed 1951:197, 200–201; McKusick this vol.). Stiger (1979:140) hypothesizes the use of turkeys for grasshopper control by Pueblo III times.

Compared to the adjacent Mogollon Culture, the Anasazi were late in overall cultural development. In the acquisition of genetic materials whose ultimate origin was Mesoamerica, they were centuries behind (see discussion beyond and Table 2).

An exceptionally early Anasazi turkey (*M. gallopavo*) is a mummy from Canyon del Muerto in Canyon de Chelly, estimated to date to A.D. 250 (Schorger 1961, 1966:20, 1970). It is from a race unknown in the wild. McKusick (pers. comm.) believes the dating is correct.

Turkey bones are found in late Archaic Basket-Maker-like deposits from southern New Mexico (Burnet Cave, Pratt Cave, and perhaps the dump material from Conkling Cavern). Presumably these people had a good agricultural base and were capable of maintaining captive turkeys, but little ethnobiological material was salvaged from these earlier excavations.

Mogollon Culture (Mountains)

Evidence for the domestication and use of turkeys in the mountainous areas of the Southwest occupied by the Mogollon peoples (Fig. 2) is equivocal. Reed (1951:202) states categorically that "the turkey was certainly not domesticated or

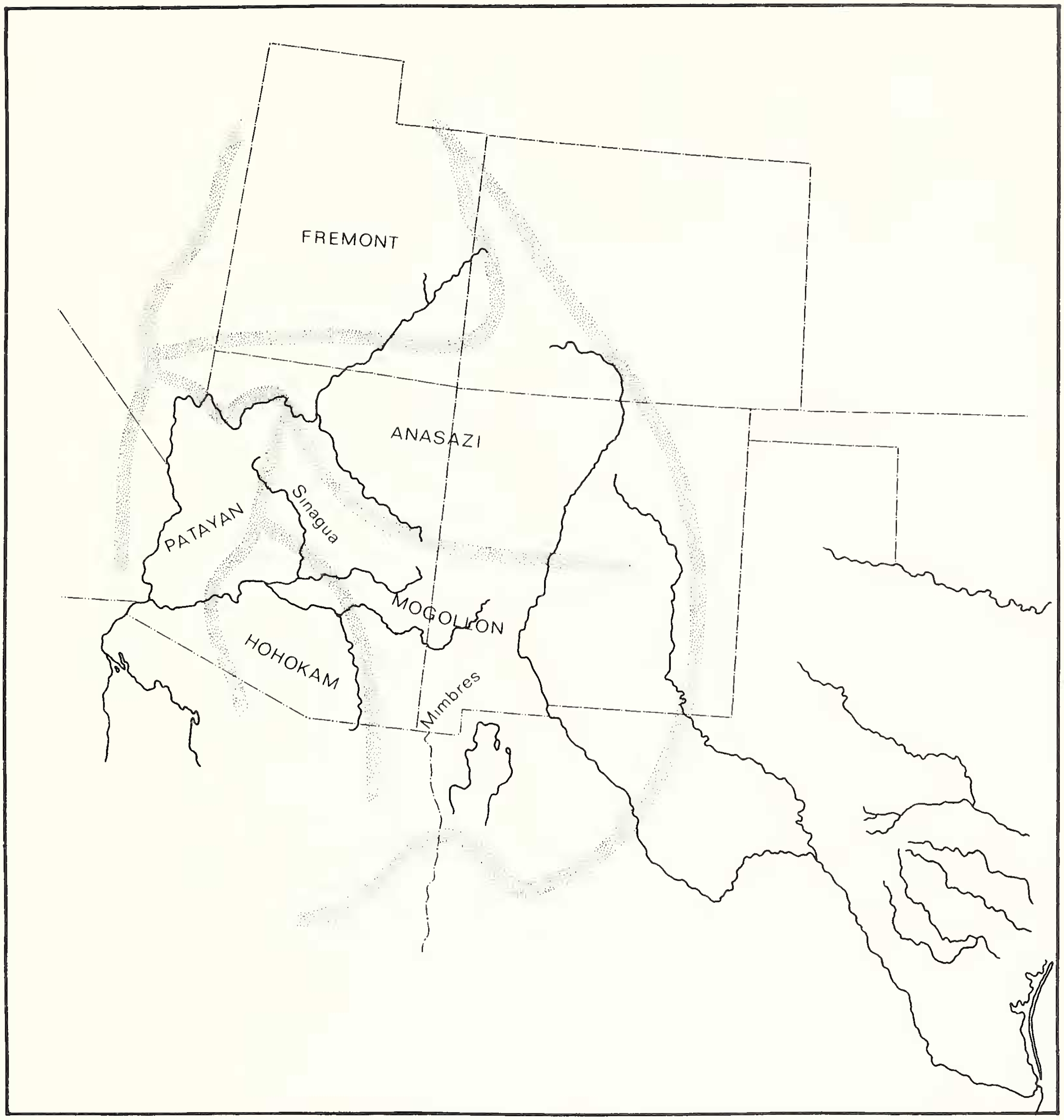

Figure 2. Generalized southwestern cultural areas, ca. A.D. 700–1100. (Modified from various sources.) Four major cultural areas are shown. The Mimbres is a late local development of Mogollon Culture. The Sinagua sub-area resulted from influences of Anasazi, Hohokam, and Mogollon. Also late was a Puebloid influenced sub-culture (not shown) along the Hohokam-Mogollon interface, often considered a distinct culture, the Salado.

kept by the Mogollon Pueblo groups of the forested uplands." (Such statements rely heavily on the presumption that wild turkeys were available; e.g., Haury 1936:93.) However, turkeys clearly were being raised in Tularosa Cave where Hough (1914:5) reported finding desiccated chicks, eggs, and great quantities of droppings. Schorger (1961) reported finding the crop of an adult mummy filled with a variety of colored flint corn grown by the Mogollon people between A.D. 500 and 700. Martin et al. (1952:499) noted that turkeys appear in the Mogollon record (Pine Lawn Phase, 2150 B.P. to A.D. 500) several centuries earlier than in the Anasazi area.

The oldest evidence for a primitive maize north of México is from Bat Cave, Catron Co., New Mexico, at levels even older than the Mogollon Culture (Dick 1965:100). This is a

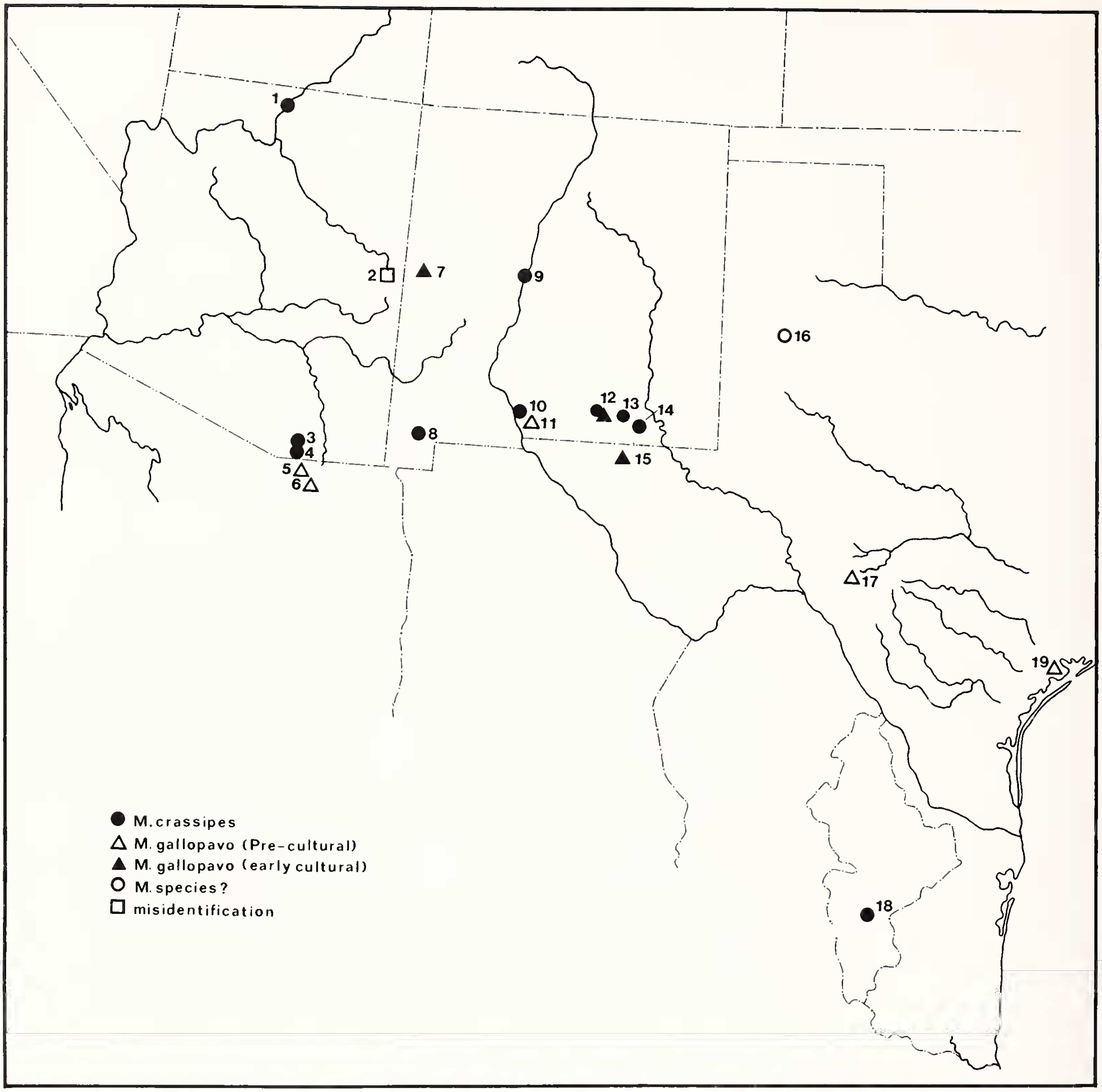

Figure 3. Localities where fossil to early cultural *Meleagris* bones have been reported from the Southwest. See Steadman (this vol.) for details on San Josecito Cavern and Ingleside Pit. 1, Stanton's Cave. 2, Laguna Salada. 3, North Papago Cave. 4, Papago Springs Cave. 5, La Brisca. 6, Arizpe. 7, Tularosa Cave. 8, Howell's Ridge Cave. 9, San Antonio Site. 10, Shelter Cave. 11, Conkling Cavern. 12, Burnet Cave. 13, Dry Cave. 14, Dark Canyon Cave. 15, Pratt Cave. 16, Lubbock Lake. 17, Klein Cave. 18, San Josecito Cavern. 19, Ingleside Pit.

pod popcorn brought into the Southwest as a *cultivated* variety, presumably from the south at least by 5500 B.P. (Dick 1965:93; Mangelsdorf 1954:409). There is a continuous and copious record of corn and its varietal progression in Bat Cave. Abundant vertebrate bones were recovered, but the bird and smaller mammal bones are still unanalyzed (Dick pers. comm.). In nearby Tularosa Cave, a primitive pod corn appears around 2000 B.P. Pottery and turkey feathers also occur about this time, their earliest occurrence in the Southwest. Some caves produced large numbers of turkey bones (Martin and Rinaldo 1950:492; Martin et al. 1952:204, 1954:155), others few or none. The presence of very few turkey bones from Mimbres sites (sometimes considered a separate culture, A.D. 700–1150) has been interpreted as absence of the bird as a domesticate. However, Mimbres people were familiar with the bird and painted it realistically on pottery.

Hohokam (Sonoran Desert)

Paralleling in time the early Basket Maker developments to the north was the Hohokam Culture in the Lower Sonoran Desert regions of southern Arizona. Like the Mogollon Cul-

Table 2. Comparison of subspecific characters of male Common Turkey, *Meleagris gallopavo.*[1]

Subspecies	Rectrix Tips	Upper Tail Coverts	Rump	Size[2]
M. g. merriami	buff or grayish white	buff to white	bluish-black	large
M. g. gallopavo	white	pale pinkish buff to white	blue-black	medium
M. g. mexicana	white	pinkish white	coppery and greenish	large
Eastern races[3]	cinnamon to chestnut	dark chestnut	glossy black (*intermedia*)	variable (large to small)

[1] After Schorger (1966) and Ridgway and Friedmann (1946).

[2] As determined by wing measurements given in Ridgway and Friedmann (1946); there is relatively little size difference between the tarsometatarsi of these subspecies (means of males range from 162 to 173.8 mm). Sample sizes are small, ranging from 1 to 11. Osteological measurements should be more indicative of actual body size of subspecies.

[3] *M. g. sylvestris, M. g. osceola,* and *M. g. intermedia.* These three subspecies are richly colored, dark-rumped races.

ture, the Hohokam had corn agriculture and ceramics by at least 2000 B.P. (Ventana Cave, Haury 1950:164–165; Snaketown, Haury 1976:117–118; Cutler and Blake 1976:365–366; Bohrer 1970), as well as an elaborate water control technology.

Turkey bones are virtually or completely absent from Hohokam sites. Several reputed bones require verification, but Haury (pers. comm.) has been unable to relocate the remains reported from the first Snaketown excavation (Haury 1937:156). The second, more thorough excavation produced no turkey bones (McKusick 1976). A supposed turkey bone necklace (Arizona State Museum, Carpenter 1977) from a San Pedro site proves to be lagomorph long bones (pers. obs.). I have identified a coracoid of a female-sized Small Indian Domestic from the Las Colinas Site (Phoenix, Arizona) that is too small and gracile for either a wild *M. g. merriami* or an intrusive barnyard female. However, it dates from the late period of Salado-Publoid intrusion, A.D. 1180–1450. I know of no good evidence of any turkey element from a pure Hohokam horizon (i.e., one without Salado cultural influence).

ORIGINS AND DEVELOPMENT OF MESOAMERICAN CULTIVARS

At least five Mesoamerican domesticates or semi-domesticates are known to have entered southwestern cultures by diffusion or direct trade. These are corn, squash of several species, gourds, beans of several species, cotton, and macaws. Another animal domesticate, the dog, *Canis familiaris,* is more ancient, and probably of Old World origin. It is known from late Archaic times (4500 B.P. at Ventana Cave, Haury 1950:158; beginning of Snaketown, Haury 1976:115, 120; from the beginning of Basket Maker II, Amsden 1949:62–65; Wormington 1978:46–47).

CORN. Various hypotheses have been advanced to explain the origin of this unique cereal. The present best archaeological evidence from the Tehuacán Valley, Puebla, México, indicates a succession from wild pod corn starting ca. 7200 B.P. (Mangelsdorf, MacNeish, and Galinat 1964:541–543). It is believed that corn diffused from Mesoamerica to the north as a pod corn, with subsequent infusions of genetic traits (Mangelsdorf 1950, 1954, 1974; Mangelsdorf and Smith 1949:213–247; Dick 1965:92–98). The oldest southwestern corn is from Bat Cave (late Cochise Culture dated 5500 B.P.). Both the Hohokam and Basket Maker peoples had corn from their beginnings.

SQUASH. Squash species (*Cucurbita* spp.) are thought to be as ancient as maize, again being derived from the south (Whitaker and Bemis 1975). Squashes were domesticated in Mesoamerica at least 9000 B.P. (Cutler and Whitaker 1961). The earliest domesticated species in the Southwest, *C. pepo,* is known from Cordova and Tularosa Caves and at Bat Cave (5500 B.P.) in the Mogollon region (Martin et al. 1952; Dick 1965). The earliest verifiable remains of *C. mixta* and *C. moschata* in the southwest are from Pueblo II times (A.D. 900–1050), many centuries after the first appearance of *C. pepo.*

BOTTLE GOURD. The one species of bottle gourd, *Lagenaria siceraria,* is common to the Old and New World (Cutler and Whitaker 1961). It appears in the Mexican archaeological record at 9000 B.P. (Tamaulipas, MacNeish 1958). The bottle gourd appears in remains dated at around 2300 B.P. in Tularosa and Cordova Caves in the Mogollon area (Martin et al. 1952:475). Verifiable remains from the Anasazi area are from A.D. 608–683 and 610 (Cutler and Whitaker 1961). The Hohokam had the gourd by the Sacaton Phase (A.D. 900–1100; Haury 1976:183).

BEANS. Two species of beans were particularly important in Southwestern cultures. The oldest known, a kidney bean (one variety of *Phaseolus vulgaris*), appears in deposits dated between 3000 and 2500 B.P. in Bat Cave (Dick 1965:98–99). In Tularosa Cave it appears in remains from 2300 B.P., along with maize and pepo squash (Kaplan 1956:218). The Hohokam had the kidney bean before 2000 B.P. (Haury 1976:118, 346; Bohrer 1970:425), but the Anasazi probably acquired it later in Basket Maker III times (Amsden 1949:132; Wormington 1978:55). It appears in the archaeological record in Tamaulipas and the Tehuacán Valley of México 5000 to 7000 B.P. (Kaplan 1967).

A second bean species important in Southwestern cultures is the tepary (tepari) (*Phaseolus acutifolius*). The tepary appears among the Hohokam remains in the Sacaton Phase of Snaketown (A.D. 900–1100; Haury 1976:118, 338; Kaplan 1956:219) and in deposits near Tucson dating from about A.D. 900–1200 (Bohrer, Cutler, and Sauer 1969:4–5). Carlson (1963) records teparies from a Basket Maker III site dated ca. A.D. 700. The tepary was apparently absent from Bat Cave (Smith 1950; Dick 1965:98–99) and Tularosa and Cordova Caves (Martin et al. 1952:474–475). Kaplan (1956:218) suggests the tepary was introduced to the Mogollon area after A.D. 1100. MacNeish (1964:534) recorded it as a domesticate in the Coxcatlán Phase of the Tehuacán Valley, Puebla, between 7200 and 5400 B.P. (see also Kaplan 1967:208–210).

Two other species of beans, the lima, *Phaseolus lunatus,* and the jack bean, *Canavalia ensiformis,* were grown in the Southwest (Kaplan 1956). The lima appears in late deposits (A.D. 1200–1400 in the Verde Valley, Arizona). *Canavalia*, a tropical derivative, appears in Hohokam, Anasazi, and Salado ruins dated about a century later (Sauer and Kaplan 1969).

COTTON. Cotton, *Gossypium* sp., was a cultivar in the Tehuacán Valley, Puebla, as early as 5400 to 4300 B.P. (MacNeish 1964:536). The Hohokam probably arrived with this crop (Haury 1976:118, 346; Bohrer 1970:425). Some cotton fiber is present in Tularosa Cave (Martin et al. 1952:475). Cotton cloth made its initial appearance here at the beginning of the San Francisco Phase (ca. A.D. 700), as did the bow and arrow. McGregor (1965:246) and Wormington (1978:69–70) place the introduction of cotton to the Anasazi region during Pueblo I period (A.D. 700–900). This cultivar is a Mesoamerican derivative (see Kent 1957 for a discussion of origins).

MACAW. The Scarlet Macaw, *Ara macao,* and the Military Macaw, *A. militaris,* were kept in captivity by early Southwestern peoples. The Scarlet Macaw was an important trade item to all the Southwestern cultures beginning about A.D. 1100 (Hargrave 1970b). Of the two, the more southerly and the more brightly colored Scarlet Macaw accounts for most of the identifiable records. In southern Utah, the northern periphery of Anasazi culture, only macaw feathers have been recovered from archaeological sites (Hargrave 1970b:29; Emslie and Hargrave 1978; Hargrave in press).

Di Peso (1974c:272–273) discusses use and trade in Mesoamerica. In northern Chihuahua, 322 Scarlet Macaw skeletons were recovered from Casas Grandes ruins. The presence of all age stages (including eggs, nestlings, and juvenals) as well as adobe breeding pens indicates that this city was an important breeding center for the late macaw trade to the north (Di Peso 1974b:182–185; Di Peso 1974c:267, 269, 272–273; McKusick 1974). Macaws were a source of feathers for ceremonial purposes. Lifelike macaws, some eating corn, are depicted in late pueblo kiva (ceremonial room) murals (Smith 1952; Hibben 1975). The descendants of the Anasazi still use macaw and other parrot feathers ceremonially.

CULTURAL EXCHANGE BETWEEN MESOAMERICA AND THE SOUTHWEST

The advanced civilizations of México and Central America profoundly modified the southwestern cultures through time. Their influence included not only the exchange of ideas, raw materials, and manufactured items, but also the direct transmission of cultivars (corn, squash, gourds, beans, and cotton) and live birds (macaws). Although this exchange extended over two millenia, dynamic periods of especially strong influence can be detected. Early in the proto-agricultural and early agricultural record there were considerable temporal differences as to when elements were acquired by various recipient cultures (contrast Mogollon with Anasazi, for instance). But by A.D. 700 a definable constellation of derivatives, mostly Mesoamerican, arrived cross-culturally in the Southwest (Table 2). Many of these elements represent genetic modifications of crops from the advanced cultures to the south.

Di Peso (1974a:104) perceives A.D. 700 ± 50 as a period of great transition between Mesoamerica and the northern frontier: "Something occurred which stirred some of the northern frontiersmen. Perhaps it was a motivation which emanated from the great cities located south of the Tropic of Cancer. Here the famed Teotihuacán culture of the Mesa Central had just come to a disastrous end. . . . In the Tehuacán Valley, it was the time of the Venta Salada Phase, when full-time agriculturalists irrigated their fields and lived in large communities associated with separate ceremonial cities. It is thought that in certain areas south of the Tropic of Cancer, the population increased 5000-fold over the original number. Many of these people were engaged not only in agricultural pursuits but in commerce, salt-making, cotton processing, and other industries which raised their living standards."

Di Peso's *Puchteca* (merchant) class may have arisen at this time. For earlier periods, actual routes are less well known. At any rate, in the centuries following A.D. 700, an enormous network in trade in turquoise and other minerals, ceramics, birds, feathers, hides, textiles, shell, and slaves developed between the city of Casas Grandes in Chihuahua and the surrounding northern frontier, extending throughout Hohokam, Mogollon, and Anasazi country (Di Peso 1974b: note especially pp. 129, 144, 171, and 193).

As with the various cultivars, turkeys, a small breed of *M. gallopavo,* were present in the Mogollon area by 2000 B.P. (Tularosa Cave). There were several breeds imported (McKusick this vol.), most likely from several source areas. About A.D. 700, *whole* turkeys, not just feathers, appear in the southern Anasazi archaeological record. Complete turkeys did not arrive in southern Utah until Pueblo II time, around A.D. 900 (Emslie and Hargrave 1978). The turkey spread among agricultural people (except the Hohokam) raising three subsistence crops (corn, squash, and beans). The addition of the third crop (beans) apparently gave a sufficient caloric base for maintaining turkeys as a domestic animal, not generally used as food. Another cultigen (or perhaps only a cultivar), the sunflower (*Helianthus* spp.), may have been an additional source of turkey feed.

From around A.D. 1350 to 1450, the entire Southwest underwent a period of population decline and areal contraction known to archaeologists as "The Great Abandonment." Although the decline was most conspicuous in the Anasazi on the Colorado Plateau because of the great number of large masonry sites, the Hohokam also disappeared at this time, and the Mogollon/Mimbres Culture a little earlier (Haury 1976:351–357; Wormington 1978:107, 144, 161, 166; McGregor 1965:420–421, 426, 428, 433). Thus, the demographic sequence consisted of a slow (±1000 years) population build-up and expansion, followed by a rapid decline. Though intensively studied and debated by archaeologists, ecologists, dendroclimatologists, geologists, and palynologists, no simplistic solutions satisfactorily explain the causality of the Great Abandonment. Perhaps the combined demographic/ecologic model of Martin and Plog (1974:318–333) comes closest.

Regardless of causal factors, the results were the same: Pueblo and puebloid-influenced population centers almost completely disappeared. These included the villages with their great herds of turkeys (McKusick this vol.). Flocks were abandoned to fend for themselves. I propose that at this time, if not before, the turkey became feral locally throughout what is the modern range of the subspecies *M. g. merriami* (Fig. 1). It filled the niche in suitable habitats left vacant by the Pleistocene *M. crassipes* north of the range of the Sierra Madre

Occidental subspecies, *M. g. mexicana. Meleagris g. mexicana* probably occurred as far north as the border ranges of southwest New Mexico and southeast Arizona, below the Mogollon Rim (Aldrich and Duvall 1955; Phillips et al. 1964). Such a distributional pattern is shared by a number of other essentially Mexican montane or encinal vertebrates, including *Crotalus lepidus, C. pricei, C. willardi, Otus trichopsis, Peucedramus taeniatus, Junco phaeonotus, Nasua narica,* and *Mephitis macroura.* Native *M. g. mexicana* has been extirpated from these border ranges (Chiricahuas, Huachucas, Baboquívaris, Santa Catalinas, Santa Ritas, Peloncillos, and probably the San Luis Mountains). Some of these areas have been restocked with *M. g. merriami.* Only a few specimens of *M. g. mexicanus* were collected and preserved prior to this restocking, and these records suggest the former northern limit of the Sierra Madrean subspecies.

MELEAGRIS GALLOPAVO MERRIAMI: A FERAL POPULATION?

The presumption has been that the turkey, *M. g. merriami,* occurred wild throughout suitable parts of the Southwest and that it was taken captive by the Basket Maker peoples and eventually domesticated. I suggest exactly the reverse of the above assumption. First, that Mesoamerican turkey feathers were brought to the Anasazi area by trade. Next, the live bird was imported as a domesticate, and later it became feral throughout the range of *M. g. merriami.* S. Emslie, C. McKusick, and B. Wright are of the opinion that turkeys escaped from domestication quite early, long before the Great Abandonment. The details of when the various domestic breeds and the wild form appear in the different cultural areas are discussed by McKusick (this vol.).

Some areas of the Southwest—parts of Utah, and the North Kaibab Plateau and the Hualapai Mountains of Arizona—lack native populations of *M. g. merriami* yet have suitable conifer or pine-oak habitat to support turkeys. Some of these areas (Fig. 3) have been successfully stocked in recent decades (Schorger 1966:438–439, 459). The historical absence of turkeys in these ranges tends to support the feral turkey hypothesis. *M. g. merriami* historically occurred in habitats where aboriginal peoples carried on a turkey industry or in immediately contiguous pine-oak habitats. Parmalee (this vol.) found no turkey bones among the numerous Galliformes recovered from 16 archaeological sites (5 Archaic and 11 Fremont) in Utah. Sinaguan, Patayan, Virgin River Anasazi, and Fremont peoples were not turkey raisers (McKusick this vol.). The disjunct forests in these cultural areas historically lacked turkeys. But other, similarly discontinuous habitats within the turkey-raising Anasazi area (e.g., the Lukachukai and Chuska Mountains) did host native populations.

A number of plants have become locally feral, self-maintaining populations in the arid West, after the abandonment of Anglo-European mining or ranching sites: various mustards, *Brassica* spp.; horehound, *Marrubium vulgare*; iris, *Iris* sp.; tree of heaven, *Ailanthus altissima*; to mention a few. Some southerners brought the opossum, *Didelphis v. virginianus,* to California early in the twentieth century and it rapidly spread throughout suitable parts of the state (Grinnell, Dixon, and Linsdale 1937). The Old World honey bee, *Apis mellifera,* is now widespread in the feral state. The escaped burro, *Equus asinus,* maintains stable populations on the Lower Colorado River drainage, partially filling a niche vacated by several Pleistocene species of horses, *Equus* spp. These examples demonstrate how easily feral populations may be established.

VARIATION IN EARLY CULTURAL TURKEYS

The early *M. gallopavo* that appeared in the Southwest were hardly uniform in characters. Schorger (1961) reported a relatively small mummified adult male turkey from Tularosa Cave, implying that it was a captive bird. Its distinguishing characteristic was a neck feathered to the base of the skull. Later Schorger (1970) formally described this anomaly as *M. g. tularosa,* based on two specimens from different localities. The original site description (Hough 1914:5–6) leaves little doubt that it was a domestic form: "A desiccated adult bird, parts of other individuals, desiccated chicks, and a number of eggs were found in a portion of the cave which was evidently a pen where turkeys were kept in captivity, there being great quantities of the droppings of the birds in the debris." McKusick (this vol.) finds two basic size varieties in prehistoric sites from the Southwest. Her Small Indian Domestic is the same as Schorger's (1970) *M. g. tularosa* "subspecies," and her Large Indian Domestic corresponds to present-day wild *M. g. merriami.*

Hargrave (1970a) examined feathers of a small brown-toned turkey in Sand Dune Cave (Basket Maker II, A.D. 700 or earlier), and gave these the formal name *M. g. coltoni.* All the feathers appeared to be from a single individual. According to McKusick (pers. comm.) these are juvenal-plumaged. Since normal black and white feathers occurred in the site, Hargrave reasoned that his new "subspecies" was not the result of post-mortem color changes ("foxing"). Emslie and Hargrave (1978) reported additional "*M. g. coltoni*" feathers from Westwater Ruin, San Juan Co., southeastern Utah (Basket Maker III/Pueblo I, ca. A.D. 700). I do not advocate formal nomenclatural recognition of the individual strains "*coltoni*" and "*tularosa*" because they were undoubtedly domestic birds.

CHARACTERISTICS OF THE SUBSPECIES OF COMMON TURKEY

If the turkeys that now make up the subspecies *M. g. merriami* did not evolve locally, then what was their source? There are two possibilities: from the east or from the south. The eastern woodland cultures had a subsistence base of maize, squash, and beans, but did not domesticate the turkey; they hunted it in the wild (Schorger 1966:137). In the eastern part of the United States the turkey has a long continuous fossil record, extending back to the Miocene (Steadman this vol.). The eastern races (*M. g. sylvestris, M. g. intermedia,* and *M. g. osceola*) do not have subspecific characters that would suggest that *M. g. merriami* was derived from them (Table 2). The eastern races are strongly refuscent, intermediate to small in size, and lack the whitish-tipped lower rump. The races to the south appear to me to be better candidates. *M. g. merriami* may have been derived from the Large Indian Domestic breed, and this, in turn, from *M. g. gallopavo* and/or *M. g. mexicana.* The southernmost *M. g. gallopavo* is colored almost like *M. g. merriami* on the rump, tail coverts, and the tips of the rectrix, but it is considerably smaller. *M. g. mexicana,* which ranges geographically between *M. g. gallopavo* and *M. g. merriami,* is the same size as *M. g. merriami.* The bimodal size variation within each sex of puebloid turkeys (McKusick this vol.) suggests at least two parental stocks. Schorger's observation (1970:170) that his "*M. g. tularosa*" had little white in the wings and no apparent white in the rump suggest a non-Mexican source for the Small Indian Domestic breed. Its coloring, as well as its small size and odd neck feathering, do not match any wild population living today. Modern *M. g. merriami* is apparently homogeneous throughout its extensive range, with no evidence of "*M. g. tularosa*" influence. With at least five centuries of selection in the wild, loss of the great variability would be expected. McKusick (pers. comm.) believes it is futile to speculate on the origin of races since the Common Turkey has been domesticated and transported in Mesoamerica for over 4000 years.

Little is known of archaeological turkey distribution and domestication in México. Flannery (1967) found turkey in remains from about A.D. 180 (Palo Blanco phase) in the Tehuacán Valley. This is *south* of the range of wild *M. gallopavo,* in habitat that was then, as now, highly xeric (cactus-thornscrub desert). Both the domestic turkey and the dog were eaten with increasing frequency in the Tehuacán area until the time of conquest. In the Valley of Oaxaca, Flannery (pers. comm. to Hargrave) found that domestic *M. gallopavo* appeared around 2400 B.P. These are still farther from the wild range. Apparently agricultural peoples took this domesticate both to the north and to the south. Archaeological turkey remains dating A.D. 700–1300 have been found on the coastal lowlands of northwestern México, below the known range of *M. gallopavo* (Stuart Scott and Elizabeth Wing pers. comm.). This is further evidence for importation and domestication.

CONCLUSIONS

Two hypotheses are suggested by the present osteological data. The first is that only *M. crassipes* was present in the Southwest (north of the Sierra Madrean outliers) during the late Pleistocene and the early Holocene. The available data thus far support this idea. No fossil *M. gallopavo* are known from within the modern range of *M. g. merriami. Meleagris crassipes* and *M. gallopavo* have not been found together. Nor has *M. crassipes* been found associated with proto-agricultural or agricultural peoples (Archaic stage or later).

The second hypothesis is that at least two stocks of *M. gallopavo* were imported into the Southwest from the south, the east, or both, by peoples with a multi-crop subsistence base after the extinction of *M. crassipes.* The spread of *M. gallopavo* appears to be directional, following the diffusion of Mesoamerican cultigens. Turkeys from late Archaic deposits in southern New Mexico are undated. The oldest dated turkeys are from the Mogollon cultural area. Trade in turkey feathers preceded the trade in whole birds. After several centuries turkeys appeared in the southern Anasazi area, then in the northern Anasazi regions. Peripheral cultural areas to the west have little or no evidence of turkey. Although the Fremont culture had corn agriculture and apparently suitable habitat for turkey, the bird itself was probably not taken that far north. However, lacking any barriers, feral turkeys may have spread from the Mesa Verde area of southwestern Colorado throughout much of that state, resulting in the present range of *M. gallopavo.*

A third hypothesis, that domestic strains of *M. gallopavo* preceded the wild form, *M. g. merriami,* in each cultural area, is a part of McKusick's study (this vol.). The idea of the importation of Common Turkey stocks by Indians comes from Hargrave (1970) as well as Schorger (1961, 1966, 1970).

ACKNOWLEDGMENTS

Many people contributed ideas that became incorporated into this study. Credit must first go to the late ethnobiologist, Lyndon Lane Hargrave, who suggested a critical look at fossil turkeys. Storrs Olson and David Steadman both turned over to me their data on *M. crassipes* from a number of southwestern sites, and Steadman assisted with many of the identifications. Charmion McKusick assisted with the cultural aspects from her years of study of this species in archaeological contexts. Both Steadman and McKusick offered extensive comments on earlier drafts of this paper. Steve Emslie and Barton Wright read the paper and shared their expertise in southwestern archaeology.

I thank all the curators who loaned paleontological and archaeological remains of turkey. Evelyn Burnett and Deanne Deméré typed drafts of the manuscript. Eric Lichtwardt prepared the maps. Portions of this study were supported by National Science Foundation Grant NSF-BNS-77-08585.

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